

Applying Commercial Processes to Defense Acquisition

If the DoD is to Attract World-class Manufacturers,
It Must Become a World-class Customer

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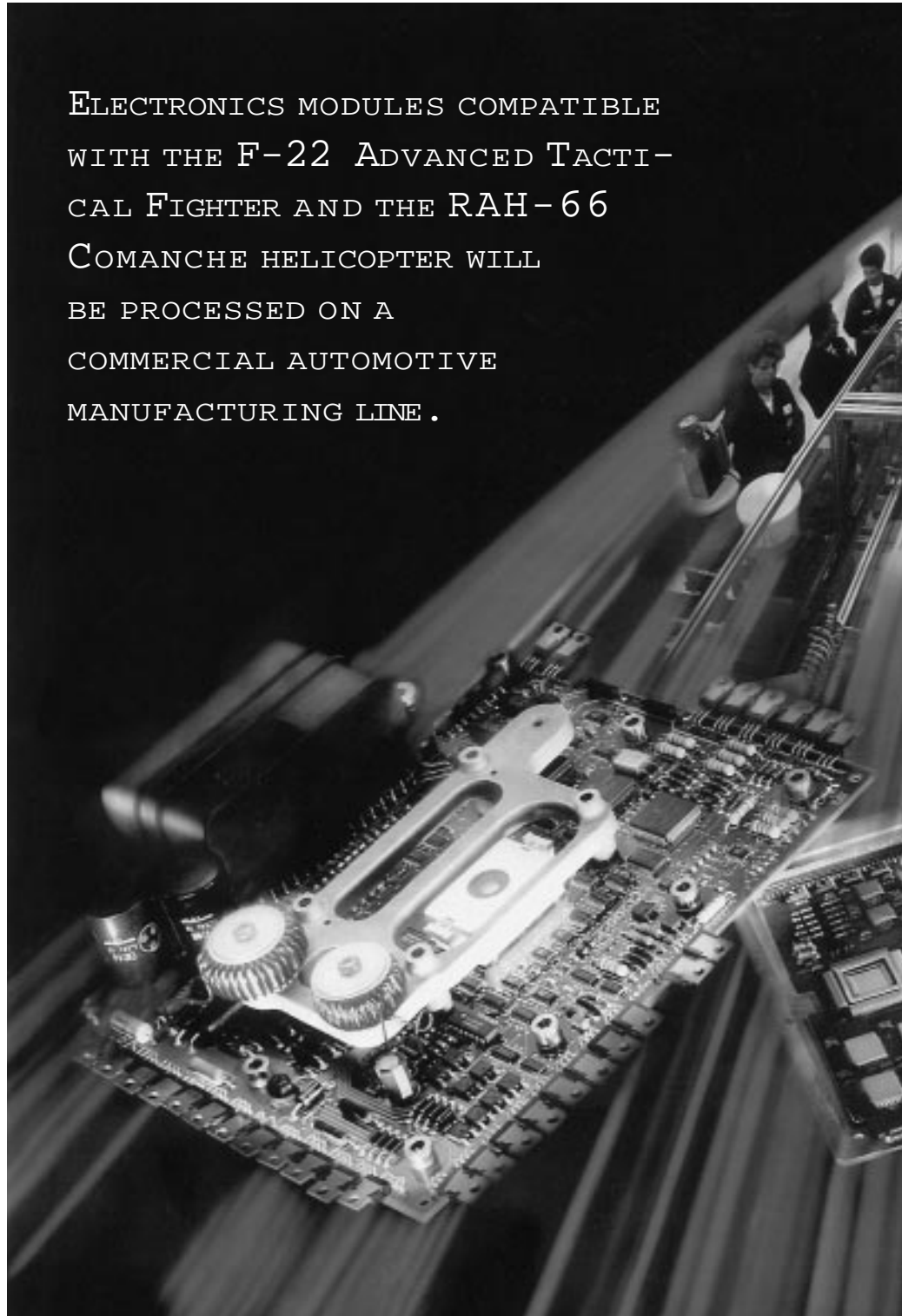
As the traditional defense industrial base decreases in both size and capability, the Department of Defense (DoD) must increasingly turn to the commercial sector to meet its future security requirements. A shift to the commercial sector is a way to contain both the cost and the time it takes to procure weapon systems. Of particular interest to the DoD are those firms that are capable of dual-use manufacturing. The advantages of dual-use procurement include access to more affordable, high-quality production facilities, and in some cases, greater technical expertise. In spite of these benefits, few examples of purely commercial firms making military-unique products exist.

Industry's Reluctance and Why

For a number of reasons, both real and perceived, many dual-use capable firms are reluctant to do business with the DoD. Government work comes with a reputation for excessive and burdensome oversight, compliance and reporting requirements. While these companies are willing to provide commercial products to the DoD on normal business terms, they are unwilling to change their internal operations to produce military-unique products, especially for what is per-

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A world-class commercial manufacturer can produce electronic modules similar to those required by the military using a relatively simple contract. Commercial contracts have significantly fewer terms and conditions. They also have fewer technical specifications and standards when compared to similar military contracts. An Industrial Base Pilot (IBP) program administered

by the Manufacturing Technology Directorate of USAF Wright Laboratory directly addresses the issues associated with integrated manufacturing. The objective of the "Military Products From Commercial Lines" IBP is to demonstrate the production of military components on a commercial line at lower cost (30-50 percent below the military baseline) and at comparable quality to those produced on a dedicated military line. The IBP will employ a commercial automotive manufacturing line to produce demonstration electronic modules compatible with both the Air Force F-22 Advanced Tactical Fighter and the Army RAH-66 Comanche Helicopter.

Background

The decline in both the acquisition budget and the defense industrial base makes it clear that the Defense Department must change the way it procures weapon systems. To address this issue, DoD conducted numerous industrial base studies plus Congress enacted changes in the Federal Acquisition Regulation (FAR) and the DoD Acquisition Policy (the 5000 Series Directives).

Manufacturing 2005

The "Military Products From Commercial Lines" IBP program traces its origins to the Manufacturing 2005 Study. This was a major investigation of the defense industrial base initiated by Air Force Systems Command. The conclusions and recommendations of 2005 were established jointly with industry. The study, completed in 1991, found that a future industrial strategy would have to accommodate decreasing defense budgets, changing enemy threats, and the realities of the commercial marketplace. Consequently, the DoD must be in a position to maintain a smaller but more robust industrial base. For this to occur, the DoD must take steps to encourage cultural changes in technical and business areas. An important conclusion of the 2005 study was that the DoD must facilitate integration of commercial and military sectors of the industrial base. The Industrial Base Pilot is one program created to test the feasibility

of such an integrated manufacturing operation.

To strengthen the industrial base, the Manufacturing 2005 assessment identified six areas that needed attention: Integrated Product and Process Development (IPPD) Methods, A Focus on Quality, Commercial and Military Integration, International Sourcing, Flexible/Lean Manufacturing, and Vertical Partnering. In response, Wright Laboratory issued a Broad Agency Announcement (BAA) in 1993 soliciting proposal abstracts that address one or more of these areas.

Of the BAA offers received, only TRW's Avionics Systems Division (ASD) proposed subcontracting to a commercial firm to demonstrate dual-use production. Its managers have extensive military experience. They proposed to redesign existing F-22 and Comanche avionics modules to allow them to be manufactured by their purely commercial TRW sister division, the Automotive Electronics Group (AEG).

Acquisition Reform Legislation

The acquisition reform initiatives of the Federal Acquisition Streamlining Act (FASA) of 1994 and the Federal Acquisition Reform Act (FARA) of 1996 were both substantial and positive. These two pieces of legislation made major inroads in the DoD's ability to go to the private sector for commercial-off-the-shelf (COTS) items. Numerous areas frequently seen as barriers to the procurement of commercial items were modified or eliminated. This includes provisions of the Truth in Negotiations Act (TINA), Cost Accounting Standards (CAS), and technical data rights.

Unfortunately, this latest round of procurement reform legislation does not directly address the case of a purely commercial firm producing military-unique items. The IBP program fits into this category. A dual-use capable firm, with no prior DoD experience, can still encounter numerous restrictive government terms and conditions



if the procurement does not meet the conditions necessary for commercial item acquisition. This situation has led to differing interpretations of the intent and applicability of the reform legislation relative to integrated manufacturing.

New DoD 5000 Acquisition Policy Update

In March 1996, the Secretary of Defense signed DoD Directive 5000.1 and the Deputy Secretary of Defense signed DoD 5000.2R. These updated directives establish the foundation for DoD acquisition policy. The revisions make significant changes in the way business is conducted within the DoD for the acquisition of both weapons systems and automated information systems.

While "Military Products From Commercial Lines" was initiated prior to the latest revision to the DoD 5000 series, the program incorporates many of the major themes found in the update. These include emphasis on five specific areas:

- *Teamwork* — To maximize overall performance.
- *Empowerment* — A shift away from rigid military specifications to encourage prudent risk management.
- *Cost as an Independent Variable* — Consideration of both performance and fiscal constraints.
- *Commercial Products* — Integrating a constricting defense industrial base with the fast-paced technology of the commercial sector to provide rapid and affordable alternatives to validated DoD requirements
- *Best Practices* — Taking into account customary commercial practices in developing acquisition strategies and contracting arrangements

The Air Force ManTech IBP meets the objectives of the new 5000 series. It also provides program managers with a preview of the opportunities and barriers inherent in turning to the commercial sector for military-unique requirements.

Purpose of the Program

The goal of the IBP program is to demonstrate the commercial production of military components at lower cost, comparable quality, and equivalent functionality to those produced on a military line. A key emphasis of the program is the identification and adoption of best practices in the acquisition of defense systems. As the IBP proceeds, the team will be collecting data, making recommendations, demonstrating best practices, and documenting areas for improvement. Those government policies and practices that hinder access to the commercial sector both in the technical and business arenas will be identified.

The IBP will show the implications of flexible manufacturing, which makes it feasible for the DoD to take advantage of existing high-quality commercial electronics production lines. Consequently, the need to establish and maintain dedicated military production lines will be significantly reduced.

Finally, it is also the goal of the IBP to transfer findings, lessons learned, and recommendations to the entire acquisition community. If the program is successful in this area, future military electronics products will be built on commercial lines at significant cost savings. This should help pave the way for other military products as well.

Criteria For Success. The IBP will focus on changing the way government and industry conduct business to facilitate the integration of commercial and military segments of the industrial base. Through commercial manufacturing demonstrations, the IBP will provide data to support the idea that the use of commercial manufacturing and business practices can save money for DoD. For IBP modules, this target cost savings is 30-50 percent as compared to the military baseline.

The IBP metrics are defined in categories that reflect program objectives: price/profit optimization, technical performance, and transfer. Therefore, the price of IBP modules must reflect the

target savings while providing reasonable profit for the commercial supplier. Technical performance must mirror military requirements in form, fit, and function, while exhibiting equal or better quality levels. And although the IBP demonstration is key, success means enabling other current and future programs to realize similar benefits. Hence the emphasis on transfer of concepts, practices, and lessons learned.

Description of Program

Electronics modules compatible with the F-22 Advanced Tactical Fighter and the RAH-66 Comanche helicopter will be processed on a commercial automotive manufacturing line. The data collected throughout the program will be used by the F-22 System Program Office and the RAH-66 Program Management Office to determine if cost savings are sufficient to warrant future purchase of commercially manufactured military electronic modules. The pilot contract, administered by ManTech, was awarded in May 1994 to TRW's Avionics System Division (ASD) and subcontracted to TRW Automotive Electronics Group (AEG).

The IBP is using an integrated product team approach to address three areas: business practices, manufacturing infrastructure, and process technology. The TRW AEG production facility located in Marshall, Illinois, was chosen because of its primary products: airbag sensor modules and diesel engine control modules, which are safety-critical and have technology similarities to the demonstration avionics modules of the pilot. The AEG facility manufactures automotive electronic products for all major automotive manufacturers worldwide.

To accomplish the objectives of the pilot, TRW ASD designers have been working with TRW AEG designers and manufacturers in a concurrent fashion to redesign the military modules for commercial production. Minimal changes will be made to an existing automotive electronics manufacturing line to fabricate the low-volume/high-cost military avionics modules. The

pilot will enhance the capabilities of AEG's computer integrated manufacturing (CIM) system to economically produce a mix of low-volume and high-volume products. Currently, AEG caters to customers with large-volume requirements.

Business Practices (BP). The IBP's BP team is examining policies and practices that discourage commercial firms from seeking government work. The areas that are being addressed include: military-unique product and process specifications, government accounting standards, cost data requirements, oversight provisions, socio-economic requirements, and technical data rights. In making recommendations for change, the BP team's strategy is to use AEG as the baseline for determining best commercial practices, define requirements without using military specifications and standards (by taking advantage of industry standards and practices), and leverage existing and ongoing acquisition reform initiatives. The BP team will capture its findings and recommendations for documentation and dissemination to the DoD acquisition community.

Early on in the IBP, analyses compared sample military and commercial contracts. These analyses simply serve as a frame of reference for the differences in the two procurement systems. A typical military contract could have as many as 183 terms and conditions. In contrast, a typical commercial contract for AEG has 27 terms and conditions. For technical specifications and standards, the military contract has 204, while a commercial contract has only 35. Another early analysis showed commercial manufacturing costs to be 21 percent of military manufacturing costs to build a similar electronics module. The challenge to the BP team, then, is to determine how defense manufacturing can benefit from the efficiencies and cost savings exhibited by the commercial manufacturer.

Manufacturing Infrastructure (MI). The MI covers the set of processes and resources employed during design and

production but not delivered as part of the final product. The MI goals are to facilitate team communication, eliminate non-value added development activities, support design activities with an emphasis on design for manufacturability (DFM), enhance computer integrated manufacturing (CIM), and optimize throughput and capital utilization.

The first step for the MI team was to evaluate the existing infrastructure at both TRW ASD and TRW AEG. The second step was to select the best characteristics from the two; for example, ASD's design tools and techniques plus AEG's manufacturing methods.

A major effort for the MI team is CIM. Functional requirements of the CIM system include a transparent design-to-production interface, rapid production changeover, production performance tracking, and mistake-proofing. A major challenge is the accommodation of low-volume lots on a high-volume, low-product mix manufacturing line. The MI team is working to enhance AEG's CIM system for maximum line flexibility. For example, the CIM system will automate software downloading and optimize lot size for more efficient changeover from product to product.

Process Technology (PT). The PT effort includes redesign of military modules for commercial production and the processing of prototype modules to validate BP and MI changes. The PT team selected two Communication, Navigation, and Identification (CNI) modules for the IBP demonstration: the Pulse Narrowband Processor (PNP) and the RF Front End Controller (FEC). Boards produced during the IBP program will be subject to the same functional and environmental tests required by the F-22 System Project Office for F-22 modules.

The conceptual design process involved both design and manufacturing engineers from the military and automotive divisions. The PT team created a design evaluation matrix that uses diverse

scoring factors weighted by level of importance for 29 different design approaches. These scoring factors included: fit, functionality, design and production risks, life cycle costs (LCC), DFM, transferability to other domestic commercial manufacturers, commonality to other platforms, obsolescence predictions, weight, and recurring and non-recurring (NRE) cost. As in commercial practice, DFM was weighted very heavily to maximize the efficiencies of a high-quality, automated manufacturing process.

The PT team is also conducting a series of tests to reduce the risk for reliability and durability prior to the IBP validation runs. Design validation (DV) hardware will be manufactured during Phase 2, and production validation (PV) hardware will be manufactured during Phase 3. Both DV and PV will take place in the AEG commercial electronics production facility in Marshall, Illinois. The F-22 and RAH-66 programs will have the option of using IBP modules for qualification and potential flight testing.

Demonstration. The two major demonstrations scheduled in the IBP are the DV and PV previously mentioned. But these demonstrations encompass more than module assembly. Other concepts will be incorporated in these demonstrations such as:

- a commercial subcontract, i.e., with commercial terms and conditions, performance specifications, and requirements based on industry standards;
- the incorporation of small lot sizes among high-volume production;
- assembly of a high-end, complex design on an automotive electronics production line;
- use of large plastic ball grid array (BGA) packages; and
- use of commercial supplier, business, and manufacturing practices.

The testing which occurs throughout IBP, in conjunction with DV and PV testing, will provide the data to determine whether or not IBP modules

Figure 1. "Four Wins"



meet military requirements. Several cost and manufacturing metrics will be used to determine the success of the other demonstrated concepts listed above. Once the DV and PV demonstrations are completed and data is collected, the IBP team will document recommendations and conclusions for transfer. These documents will include a model contract, a technical business handbook, and phase reports.

Program Management

An integrated product team approach is used to manage the IBP program. A unique aspect of this teaming approach is the inclusion of government personnel as participants, not merely as overseers. The IBP is an R&D contract within the laboratory structure, and is providing data and recommendations for immediate use by DoD system offices, their prime contractors, and sub-tier suppliers. The specific program demonstration vehicles are compatible with the F-22 and the RAH-66. Consequently, the team includes players from AF ManTech, TRW ASD, TRW AEG, F-22 System Program Office, RAH-66 Program

Management Office, Lockheed Martin (F-22 prime), and the Boeing-Sikorsky Joint Program Office (RAH-66 prime).

While a core portion of the team remains relatively fixed, the nature of the team as a whole is dynamic. Manufacturing, design, quality, contracting, policy, financial, and legal personnel, both military and commercial, are all contributors to IBP. Management challenges arise due to the number of organizations involved and their geographic distribution. Several communication tools and practices, such as weekly staff teleconferences and quarterly self assessments, have been implemented. Electronic communication is heavily relied upon to minimize travel and paperwork costs.

The Four Wins

The IBP team has established a "Four Wins" scenario that defines what each major player expects from IBP, based on organizational goals and program objectives (Figure 1). The Four Wins were generated in the early stages of IBP through team training and are used as a basis for management operations and decision making. Look-

ing at it generically, the Four Wins describe how the IBP is fundamentally designed, i.e., as a partnership between the defense contractor, the commercial supplier, the system program office, and AF ManTech, the catalyst. Such a design allows DoD systems to benefit from the demonstration, validation, and transfer of new concepts, while IBP absorbs a major portion of the risk.

Breaking Down Barriers

The IBP program is designed to identify and address barriers to business relationships between defense and commercial organizations. Any barrier – technical, business, or cultural; real or perceived – may deter the involvement of commercial manufacturers in defense work. Breaking down these barriers means defining the root of the issue, identifying possible fixes, and recommending and implementing the best solution.

Reluctance of Commercial Firms to Seek DoD Work. Many commercial firms although dual-use capable, are unwilling to engage in DoD business. Typically these firms manage successful businesses without DoD customers and, since DoD business is not perceived as a big money-maker, they are not motivated to pursue DoD work. As commercial suppliers see it, the DoD is a difficult customer with extensive reporting, compliance, and oversight requirements. Furthermore, the instability of requirements and budgets, the government's right to terminate contracts at will, the risk of a protest, and the risk of inadvertently failing to comply with a rule or regulation that will lead to criminal or civil penalties are all reasons that many companies avoid DoD business. In fact many commercial, world-class manufacturers do not even read the *Commerce Business Daily* (CBD) when seeking new work.

In breaking down this barrier, the IBP first came to the realization that world-class commercial manufacturers are not coming to DoD; DoD must find them. The next IBP revelation was that it must not only be feasible for com-

mercial suppliers to work with DoD, it must be inviting. That is, the customer must appeal to the supplier's bottom line.

The Commercial Item Definition. A major tenet of the FASA and FARA initiatives is to use commercial products to the maximum extent possible in meeting military requirements. Enactment of FASA modified or eliminated numerous barriers to reform, including TINA, CAS, and technical data rights. However these benefits are realized only if the acquisition falls under the definition of a commercial item.

The IBP has found that, although the revised acquisition regulations work well for commercial off-the-shelf items, the new regulations are not clear when it comes to procuring military-unique products from dual-use capable commercial firms. By default, the solution is to treat dual-use firms as if they were defense contractors, requiring them to adhere to unique government contracting laws designed to promote fairness, discourage fraud, and further socio-economic objectives. Extensive cost and pricing data to verify the fairness and the reasonableness of their offer are also required. Figure 2 shows the major contractual areas that pose a problem for commercial firms.

In breaking down this barrier, the IBP will attempt to demonstrate the use of the definition of commercial items on the IBP subcontract with AEG. This will set a precedent for the use of the definition for military-unique products built on dual-use commercial manufacturing lines. The IBP will furthermore recommend necessary changes to the definition, if any, such that it is clearly applicable to other programs procuring military products from commercial lines.

Cost and Pricing Issues. The most contentious area for AEG deals with the numerous cost and pricing data requirements of TINA and CAS. This issue was also identified in a 1991 study by the Center for Strategic and International Studies. The CSIS Steer-

ing Committee on Security and Technology concluded: "The cost accounting principles, standards, and reporting requirements pose a barrier both to DoD access to commercial state-of-the-art technology as well as the purchase of defense items produced in commercial facilities." Because AEG is a commercial production firm, they have not had a previous business relationship with the government. In contrast to a typical defense contractor, AEG has never generated cost data that is compliant with CAS. Instead, AEG maintains an accounting system which is compliant with Generally Accepted Accounting Practices (GAAP). Unlike CAS, AEG's accounting data are collected at a more generalized level. Costs are not differentiated between "allowable" and "unallowable." Their source documents are maintained in accordance with the federal tax code and the practices of their specific market.

In the absence of competition, the government procurement regulations require extensive cost and pricing data from those firms, defense or commercial, that make military-unique items. While the new regulations have made it easier to qualify for an exception to the cost and pricing data requirements of TINA and CAS for commercial-off-the-shelf items, it is more difficult for

military-unique products to meet the criteria of adequate price competition or one of the TINA exceptions. This occurs because a military-unique item made by a dual-use firm typically does not have a catalog or market price, or may not qualify as a commercial item.

For commercial items, it is assumed that market forces will ensure a fair and reasonable price. Under these conditions, the DoD benefits from a very competitive domestic and international market. However, when the DoD turns to the commercial sector to meet its military-unique requirements, pricing becomes a major challenge, which severely complicates access to the commercial sector. The IBP will attempt to break down this barrier by recommending a pricing approach that does not rely on extensive cost and pricing data from the supplier. This will require a thorough understanding of market research and the adoption of commercial price analysis techniques.

Being a Good Customer

While the government has become intent on taking advantage of the commercial sector, it must acknowledge that many of its business practices serve to effectively discourage potential dual-use manufacturing firms from seeking military work. Most commer-

Figure 2. Government Contracting Requirements Which Deter Commercial Suppliers

Government Requirement	Government Intent	Commercial Objection
<i>Cost and Pricing Data</i>	Ensure a Fair and Reasonable Price	Proprietary - Key to Competitive Advantage
<i>Cost Accounting Standards (CAS)</i>	Ensure a Fair and Reasonable Price	Not a Commercial Practice - Requires Costly Infrastructure
<i>Socio-Economic Provisions</i>	Ensure Equal Opportunity	Not a Commercial Practice - Costly or Non Value-added
<i>Data Rights</i>	Allows Reprocurement From Another Source	Proprietary - Key to Competitive Advantage
<i>Certifications</i>	Ensure Compliance With Statutes	Duplicates Requirements of Existing State and Federal Laws

cial firms would be willing to provide goods and services to the DoD on normal business terms. However, they are unwilling to change their internal operations to accommodate what may well be a small, one-time customer.

As the single buyer in the defense market, the DoD has significant leverage over the defense industry. It now enters the commercial market, where it is just one of many buyers. The DoD must now come to the humbling realization that in the commercial market, it deserves and will receive the same treatment as the other customers, no more and no less. Under these conditions, the DoD is no longer in a position to dictate terms and conditions.

For commercial firms, competitive markets are the driving force leading to efficient internal operations. It is rare for one customer to dictate terms and conditions that change the internal operation of another firm. On occasion, suppliers will make special arrangements for preferred customers (i.e., those that show a significant long-term commitment). However, few commercial firms would put the DoD in this preferred category.

Consequently, proper consideration must be given customary commercial practices of dual-use firms when developing acquisition strategies and contracting arrangements. If the DoD is to attract world-class manufacturers, it must become a world-class customer. First, the DoD must continue its efforts to be commercial-like in its procurement practices. This includes adopting industry standards to define requirements and adopting a design-for-manufacturability philosophy. Second, commercial firms must not view the DoD in a negative light relative to their other customers. The DoD must establish its own "past performance" track record as a trusted customer.

The Business Case

To involve world-class commercial firms in defense work requires the development of a business model that balances the commercial firm's desire

for normal profits and restricted access to cost data with the military's desire for affordable products. The IBP program has developed a model that addresses these key requirements and can serve as the basis for future contract relationships between military contractors and commercial manufacturers. The model assures the government of a lower price for its hardware, while permitting the commercial firm to protect its cost data from competitors and earn normal profits. On the IBP program, this model has been employed and yields favorable results for achieving both military and commercial goals. The business model currently indicates an average module price that is approximately 40 percent less than the military baseline.

The IBP model suggests a business process between defense contractor and commercial manufacturer. Starting with a performance specification for a product, the commercial firm estimates the bill of material (BOM), labor, and non-recurring engineering (NRE) costs to produce the product on its commercial manufacturing line. Control mechanisms in the model are the return on assets employed (ROAE) target of the commercial firm and the cost target of the military customer. Assuming these control parameters are met, a process ensues whereby defense-unique requirements are negotiated and non-value added busi-

ness practices are eliminated. If these negotiations generate acceptable terms and conditions, the result is military products from commercial lines (Figure 3).

Conclusion

With affordability becoming a critical issue in weapon system acquisition, the DoD has little choice but to turn to the commercial sector to meet its military requirements. The defense community is changing the acquisition environment to allow for new business practices and commercialization. These changes have raised several issues in implementation. Within AF ManTech, the IBP program is meeting the issues head on in its demonstration of the commercial manufacture of military products.

What the IBP provides are data and lessons learned to assist program offices in applying commercial processes to defense acquisition. Data include analysis, design, manufacturing, test and cost; and lessons learned include topics such as contracting, teaming, defining requirements, and design for manufacture. The Number 1 benefit for military products from commercial lines is cost savings for DoD systems. While program offices are learning how to implement mandated change, the IBP is demonstrating the benefits in real time.

Figure 3. The "Business Model"

